

Requirements for Validation & Verification plan (V&V)

The supplier must submit a "Verification and Validation plan" ("V&V plan") after signing the contract and no later than the Milestone "Design Freeze". The plan must include expected V&V activities from signing the contract to the FTO. The "V&V plan" will be part of the overall Project Plan to secure risk mitigation towards homologation.

At the "Design Freeze" milestone, Lokaltog will approve the "Verification and Validation plan" (V&V). The plan must include expected activities and selected Certification Bodies for the process for homologation, validation and verification until Lokaltog's final takeover (FTO) of the individual trains.

If documentation provided at a specific Milestone (according to the Milestone and Payment plan) is also included in a subsequent milestone, this must be stated.

The supplier must describe how the V&V plan's individual activities are linked to the individual Milestones in the Milestone Plan. The Supplier must also describe what documentation is required to achieve the individual milestone, including milestone M4 regarding main systems, and milestone M6 regarding train set ready for dispatch from factory.

Lokaltog will approve the data format for documentation to ensure compatibility with Lokaltogs system landscape.

The V&V plan must at a minimum include:

- The supplier's organization incl. Certification Bodies for the V&V activities.
- Plan and content of the training of Lokaltog's train instructors and technicians
- Indication of the individual V&V activity required to ensure that the supplier can achieve the full homologation of the train and authority approvals, as well as indication of how these activities are monitored and controlled.
- For V&V activities related to technical requirements from Lokaltog, for which the Supplier has not yet obtained homologation, Lokaltog requires test results for commenting, and for being able to approve the chosen technical solution.
- Schedule for all tests associated with the delivery categorized as "Type test" (one-time test) and "routine test" (test associated with each train). If "Type Test" has already been performed for other orders, and therefore does not have to be carried out for Lokaltogs delivery, the Supplier will provide the references to this.

The tests included in the V&V plan should cover the below items.

Inspections:

- Inspection of carbody directly after shot blasting (before painting, incl. primer or corrosion protection)
- Inspection of carbody after painting
- Inspection of bogie frame directly after shot blasting (before painting, incl. primer or corrosion protection)
- Inspection of bogie completely equipped

Functional test of the following Main Systems for the trains:

- train management system and system integration
- bogies and suspension
- traction systems
- current collection system
- traction motors
- transformers
- wheel sets including bearings
- gearbox
- braking system
- compressor and pneumatic system
- air conditioning
- fire detection system
- draw gear
- auxiliary power system, incl. batteries
- communication system (train <-> shore)
- inspection and test of all seats (driver and passengers)
- windscreen (impact resistance and optical performance tests)
- driver's cab controls and instruments
- passive fire safety systems, e.g., fire resistance barriers and materials 'reaction to fire' tests
- panto functions
- Start-up time including presetting of indoor temperature

Inspections, confirming that systems on the trains interface and operates as expected, of:

- cab: fitting/gluing of windows
- insulation: Side walls, floor, roof, head of train
- fitting of floor and covering
- fitting of piping, ducting, and wiring and wiring identification, e.g., insulation resistance and earthing.
- mechanical and electrical fittings
- roof mechanical and electrical fittings
- four points measuring completely fitted carbody
- fitting of bogies
- exterior doors and handrails
- inspection of the quality, integration, and assembly of the Main Systems
- fire detection and suppression system (if applicable)
- radio
- safety relevant functions
- measuring of the train's dimensions
- weighing
- fitting end-test of roof, underframe, train outside and inside
- speed
- acceleration
- braking incl. emergency braking and parking brake
- blending of electrical and mechanical brakes
- internal and external lighting
- heating, Ventilation and Air Conditioning (HVAC) systems

- water tightness test
- windscreen wiping/washing equipment
- noise tests
- warning horn noise tests (electrical horn and two-tone typhoon)
- remote data transfer (e.g., between train management system and shore, as well as recording capacity of CCTV)
- EMC (immunity and emitted interference)
- WTB (Wired Train Bus)
- charging cables 1000/1500V
- service cables 400V

Maintenance Demonstration Test

The test will be carried out at the supplier's facilities and executed by Lokaltog's workshop staff just after they have completed their training. The test must be carried out on a Lokaltog train or on a similar train (or components) with Lokaltog's prior approval. The MDT is governed by the Supplier's personnel.

The test has three purposes:

- a) The test must confirm that Lokaltogs employees have acquired the necessary competencies to carry out maintenance jobs of the train.
- b) The test must identify whether the maintenance of the new trains will require changes in Lokaltog's safety procedures prior to the deployment of the trains.
- c) The test can include all preventive inspections and typical replacements of wearing parts for a train that has covered 500,000 km (nearest inspection interval thereafter). In addition, Lokaltog suggest, that the following activities are carried out as well, should they not be included in the preventive maintenance job as described in bullet 2.a:
 - disassembly and assembly of motorized bogie
 - replacement of main shafts and carrying axles
 - lifting the train via mobile lifting towers
 - replacement of headlights (top lantern and one side lantern)
 - replacement and calibration of entrance door
 - installation and disassembly of the emergency coupler
 - replacement and calibration of complete pantograph while mounted on the roof of the train
 - replacement of carbon strip on pantograph
 - replacement of HV cables on the roof of the train (if applicable)
 - dismounting and mounting of front coupler
 - Calibration of carbody height

When replacing, the component on the train has been removed and the same component installed again.